

SHORT NOTE

The genus *Kirchneriella* Schm. (Chlorophyceae) in Argentina: Taxonomy and geographic distribution

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Abstract – This note deals with the taxonomic study and geographic distribution of the genus *Kirchneriella* Schm. in Argentina, where species and infraspecific taxa have received little attention. The classification of taxa is based on morphological and morphometric characters. Thirteen species and three varieties are recorded, among them *K. contorta* var. *elegans* (Playf.) Kom., *K. danubiana* Hind., *K. irregularis* var. *spiralis* Korš. and *K. obtusa* (Korš.) Kom. are new records for Argentina.

Argentina / biogeography / Chlorophyceae / *Kirchneriella* / taxonomy

Résumé – Le genre *Kirchneriella* Schm. (Chlorophyceae) en Argentine. Taxinomie et distribution géographique. Ce travail est consacré à l'étude taxinomique et à la distribution géographique du genre *Kirchneriella* Schm. en Argentine, où les espèces et les taxons infraspecifics ont reçu peu d'attention. La classification des taxa est basée sur les caractères morphologiques et morphométriques. Treize espèces et trois variétés, parmi lesquelles *K. contorta* var. *elegans* (Playf.) Kom., *K. danubiana* Hind., *K. irregularis* var. *spiralis* Korš. et *K. obtusa* (Korš.) Kom. sont observés pour la première fois en Argentine.

Argentine / biogéographie / Chlorophyceae / *Kirchneriella* / taxinomie

INTRODUCTION

About 1000 samples of fresh-water algae collected all over Argentina have been studied during the last 35 years for taxonomic and ecological purposes. This research produced more than two hundred papers reporting the numerous algae recorded, and among these, the genus *Kirchneriella* Schm. (Chlorophyceae)

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has received little attention. So far, in Argentina there are only few reports dealing with the systematic of the genus and nothing is known about its geographic distribution. Argentina, located in the south of South America, shows warm, temperate and cold climates, and encompasses several wetlands and freshwater bodies such as lakes, reservoirs, ponds, rivers and shallow lakes favourable for the development of planktonic species of *Kirchneriella*.

Kirchneriella is a well-defined genus (Komarek & Fott, 1983) belonging to the family Selenastraceae (Chlorophyceae, Chlorophyta). In a study involving molecular analysis, Krienitz *et al.* (2001) stated that cell shape, colony formation, arrangement of autospores within the mother cell wall, and shape and ultrastructure of pyrenoids are inappropriate criteria for the systematics of the Selenastraceae family. Instead, the authors found that they can be used for differentiation at the species level. Based on morphological features and cell size, Komarek & Fott (1983) described eighteen species, and the *Index Nominum Algarum* (2007) lists over twenty species belonging to the genus *Kirchneriella*, with infraspecific taxa included in both cases. Most of the taxa are distributed worldwide, except for some restricted groups, and species are frequently found in a variety of water bodies but usually in small numbers. Up to now, thirteen species and three varieties are recorded for Argentina, all of which are well known and widely distributed in the world. *K. contorta* var. *elegans* (Playf.) Kom., *K. danubiana* Hind., *K. irregularis* var. *spiralis* Korš., *K. irregularis* var. *spiralis* Korš., and *K. obtusa* (Korš.) Kom. are new records for Argentina.

MATERIAL AND METHODS

The sampling sites covered a large part of Argentina, from warm (24°19'S) to cold regions (54°47'S). The samples were collected with a 15-25 µm pore net in different periods, approximately between 1980 and 2005. For microscopic observations, the material was either fresh or fixed in 3% formalin.

The descriptions of the species and varieties found in the samples only refer to general morphological features and cell size. For a detailed description of each species, see Komarek & Fott (1983). Maps in Fig. 17 show the distribution of the species included in this study. The citations of provinces are based on our own data and on the publications of other researchers.

RESULTS

The genus *Kirchneriella* Schm. is characterized by the following features: colonies planktonic, microscopic, with (1) 2-16 (rarely more) cells included within a homogeneous gelatinous envelope. Cells crescent-shaped, cylindrical, vermiform, curved or twisted with rounded or pointed ends. There is a solitary chloroplast. Thirteen species and three varieties are recorded for Argentina. Only a few individuals of each species were found in the different water bodies studied. Figs. 1-16 illustrate the taxa recorded and Fig. 17 shows their geographic distribution in Argentina. Five of the sixteen taxa reported here (*Kirchneriella contorta* var. *elongata*, *K. microscopica*, *K. phaseoliformis*, *K. pinguis* and *K. pseudoaperta*) were not observed by us, but instead obtained from the literature.

Kirchneriella aperta Teil.**Fig. 1**Syn.: *Kirchneriella obesa* var. *aperta* (Teil.) Brunnth.

Colonies spherical to ellipsoid, composed of 4-16 cells irregularly arranged within the gelatinous envelope. Cells strongly curved, crescent-shaped, rather inflated. Concave side opened in V-shape. Cell apex rounded. Cell size: 6-9 μm diam.

It is a rare species previously reported from the Northern hemisphere. It was recorded three times in Argentina in small shallow lakes and ponds (Buenos Aires, Corrientes and Tierra del Fuego Provinces, warm, temperate and cold waters).

Kirchneriella contorta (Schm.) Bohl. var. *contorta***Fig. 2**Syn.: *Kirchneriella obesa* var. *contorta* Schm.

Colonies small, irregular or ellipsoid, composed of 4-16 cells irregularly arranged within the gelatinous envelope. Cells vermiform, cylindrical, many times longer than wide, curved or twisted. Cell apex rounded. Cell size: 7-12 $\mu\text{m} \times 1-2 \mu\text{m}$.

The species is cosmopolitan. It was recorded four times in Argentina in ponds and shallow lakes (Buenos Aires, Corrientes, Rio Negro and Tierra del Fuego Provinces, warm, temperate and cold waters).

Kirchneriella contorta var. *elegans* (Playf.) Kom.**Fig. 3**Syn.: *Kirchneriella elegans* Playf.

Colonies composed of a few cells. Cells cylindrical, curved, with concave and convex parallel margins. Cell apex rounded. Cell size: 7 $\mu\text{m} \times 2 \mu\text{m}$.

The species is cosmopolitan. It is a new record for Argentina, in a shallow lake (Corrientes Province, clear and warm waters).

Kirchneriella contorta var. *elongata* (G. M. Smith) Kom.**Fig. 4**Syn.: *Kirchneriella elongata* G. M. Smith

Colonies composed of many cells irregularly distributed within a gelatinous envelope. Cells cylindrical, many times longer than wide, twisted. Cell apex rounded. Cell size: 20-30 $\mu\text{m} \times 2-3 \mu\text{m}$.

The species is probably cosmopolitan, but rare. This variety was absent in our material. It was recorded in Argentina from a temperate, mesotrophic shallow lake (Chubut Province, cold waters).

Kirchneriella danubiana Hind.**Fig. 5**

Colonies spherical or ellipsoidal, composed of 4-16 cells. Cells almost cylindrical, curved, with more or less parallel convex and concave margins. Cell apex rounded. Cell size: circa 10-12 $\mu\text{m} \times 3-4 \mu\text{m}$.

It is a rare species. This is the first record of the species in Argentina, in a shallow lake (Corrientes Province, clear and warm waters).

Kirchneriella dianae (Bohl.) Comas**Fig. 6**Syn.: *Kirchneriella lunaris* var. *diana*e Bohl.

Colonies almost spherical or irregular, with (2)-4-64 cells frequently grouped in radial clusters of 4-8 cells. Cells crescent-shaped, with apex pointed. Cell size: 12-18 $\mu\text{m} \times 3-5 \mu\text{m}$.

The species is cosmopolitan. It was recorded twice in Argentina in shallow lakes (Corrientes and Buenos Aires Provinces, warm and temperate waters).

***Kirchneriella irregularis* (G. M. Smith) Korš. var. *irregularis* Fig. 7**

Colonies almost spherical or irregular, with 4-16-(64) cells irregularly distributed within the gelatinous envelope. Cells crescent-shaped, strongly curved, sometimes somewhat twisted. Cell apex pointed. Cell size: 10-18 $\mu\text{m} \times 3-5 \mu\text{m}$.

The species is cosmopolitan. It was recorded twice in Argentina in shallow lakes (Corrientes and Buenos Aires Provinces, warm and temperate waters).

***Kirchneriella irregularis* var. *spiralis* Korš. Fig. 8**

This variety is characterized by having twisted cells. Cell size similar to that of the type.

The species is probably cosmopolitan. This is the first record of this variety in Argentina, in a shallow lake (Corrientes Province, clear and warm waters).

***Kirchneriella lunaris* (Kirchn.) Moeb. Fig. 9**

Syn. : *Raphidium convolutum* var. *lunare* Kirchn.

Colonies spherical or rather irregular, with 16-(rarely 64) cells commonly arranged in radial clusters of 4-8. Cells strongly curved, crescent-shaped, with pointed ends. Cell size: 10-13 $\mu\text{m} \times 4.5-5 \mu\text{m}$.

The species is cosmopolitan. It was recorded many times in Argentina in shallow lakes (Buenos Aires, Cordoba, Corrientes, Rio Negro, Santa Cruz and Tierra del Fuego Provinces, warm, temperate and cold waters).

***Kirchneriella microscopica* Nyg. Fig. 10**

Colonies irregular, small, with a few cells. Cells approximately cylindrical to crescent-shaped. Cell apex rounded. Cell size: 3.8-4.5 $\mu\text{m} \times 1.5-2 \mu\text{m}$.

It is a rare species, absent in our material. It has been cited for Argentina in shallow lakes (Entre Rios and Buenos Aires Provinces, temperate waters).

***Kirchneriella obesa* (W. West) Schm. Fig. 11**

Syn. : *Selenastrum obesum* W. West

Colonies more or less spherical, with 4-16-(rarely 32) cells. Cells inflated, crescent-shaped, with rounded ends. Internal margins U-shaped or V-shaped. Cell size: 10-13 μm diam.

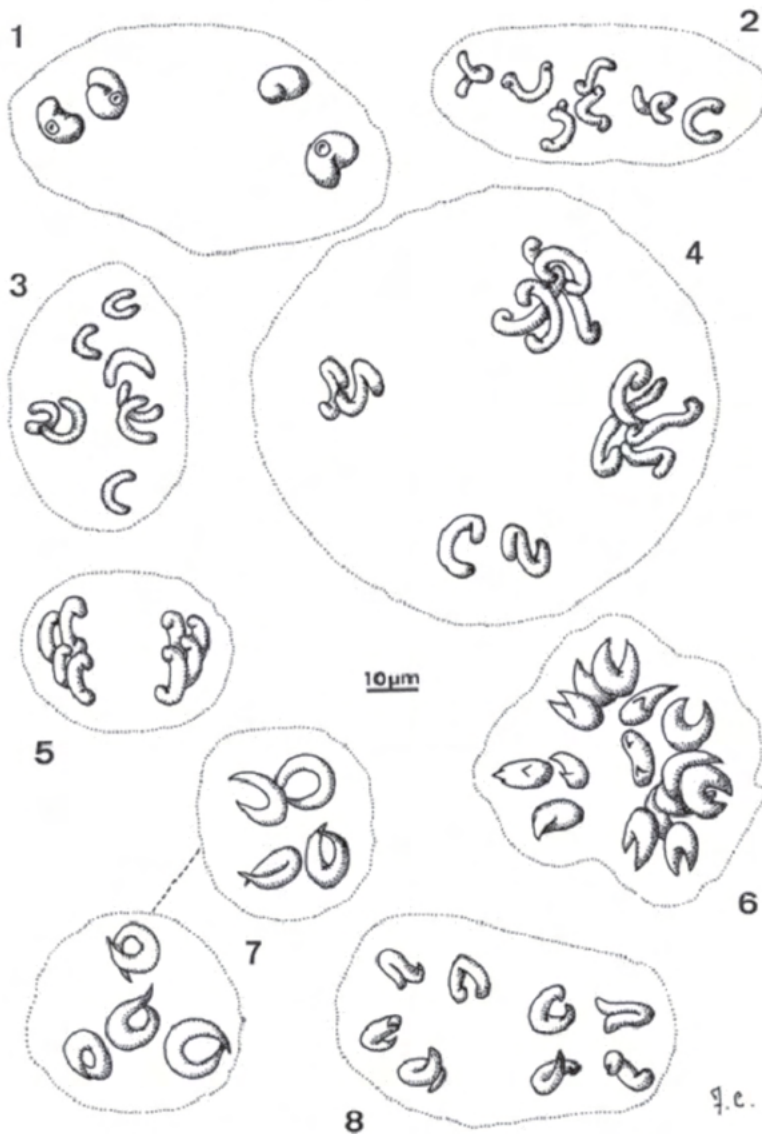
The species is probably cosmopolitan. It was recorded seven times in Argentina in shallow lakes (Buenos Aires, Chubut, Corrientes, Rio Negro, Santa Cruz, and Tierra del Fuego Provinces, warm, temperate and cold waters).

***Kirchneriella obtusa* (Korš.) Kom. Fig. 12**

Syn. : *Coenochloris obtusa* Korš.

Colonies lengthy oval to clearly elongate. Cells elongated, rather inflated in the middle region, asymmetric, very slightly curved. Cell apex rounded. Cell size: 15-16 $\mu\text{m} \times 4.5-5 \mu\text{m}$.

This is a rare species. This is the first record in Argentina, in shallow lakes (Corrientes Province, warm waters).



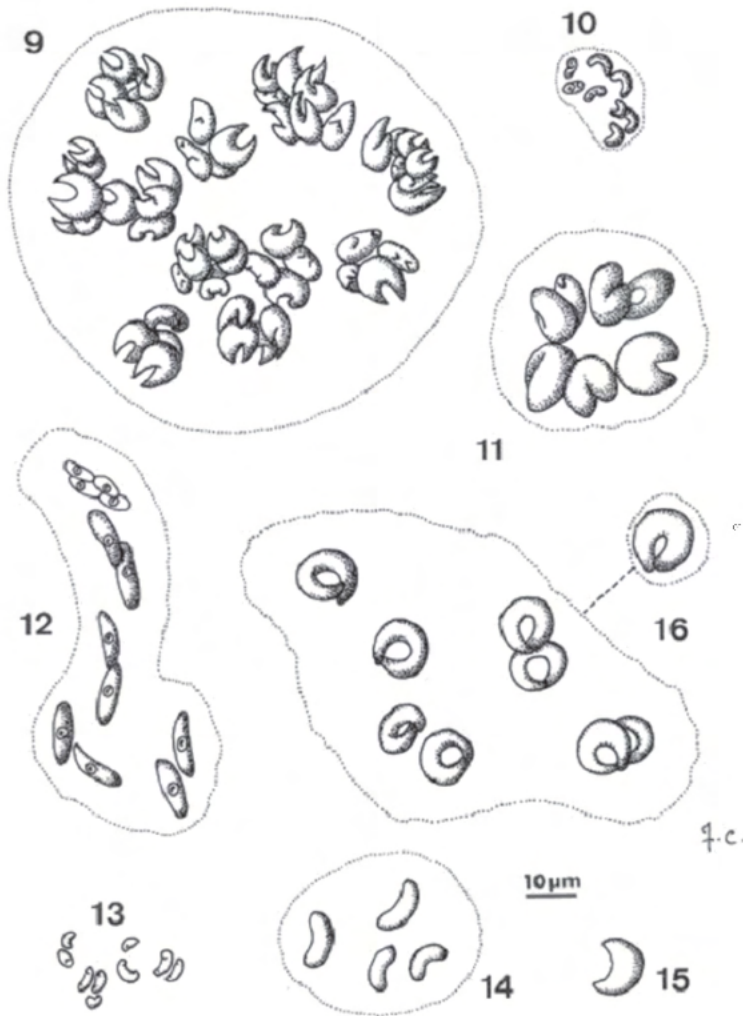
Figs 1-8. 1. *Kirchneriella aperta* Teil. 2. *K. contorta* (Schm.) Bohl. var. *contorta*. 3. *K. contorta* var. *elegans* (Playf.) Kom. 4. *K. contorta* var. *elongata* (G. M. Smith) Kom. (after Guarrera, 1977). 5. *K. danubiana* Hind. 6. *K. diana* (Bohl.) Comas. 7. *K. irregularis* (G. M. Smith) Korš. var. *irregularis*. 8. *K. irregularis* var. *spiralis* Korš.

***Kirchneriella phaseoliformis* Hortob.**

Fig. 13

Colonies irregular, with a few cells. Cells bean-shaped. Cell size: 3-4.5 μm \times 1.5-2 μm .

The species is probably cosmopolitan, absent in our material. It has been cited for Argentina in shallow lakes (Buenos Aires Province, temperate waters).



Figs 9-16. 9. *Kirchneriella lunaris* (Kirchn.) Moeb. 10. *K. microscopica* Nyg. (after Izaguirre *et al.*, 1991). 11. *K. obesa* (W. West) Schm. 12. *K. obtusa* (Korš.) Kom. 13. *K. phaseoliformis* Hortob. (after Echenique & Arenas, 1994). 14. *K. pinguis* Hind. (after Guarrera & Echenique, 1992). 15. *K. pseudoaperta* Kom. (after Echenique & Arenas, 1994). 16. *K. rotunda* (Korš.) Hind.

***Kirchneriella pinguis* Hind.**

Fig. 14

Colonies irregular, small, with a few cells. Cells bean-shaped. Cell size: 8-15 $\mu\text{m} \times 4 \mu\text{m}$.

The species is probably cosmopolitan, absent in our material. It has been cited for Argentina in shallow lakes (Entre Rios Province, temperate waters).

***Kirchneriella pseudoaperta* Kom.**

Fig. 15

Colonies irregular, composed of 4-64 cells or comprising a single cell. Cells crescent-shaped. Cell size: 12 $\mu\text{m} \times 6 \mu\text{m}$.



Fig. 17. Geographic distribution of the species of the genus *Kirchneriella* in Argentina.

The species is probably cosmopolitan, absent in our material. It has been cited for Argentina in shallow lakes (Buenos Aires Province, temperate waters).

***Kirchneriella rotunda* (Korš.) Hind.**

Fig. 16

Syn. : *Ankistrodesmus rotundus* Korš.

Colonies composed of 2-4-8 cells or comprising a single cell. Cells twisted, more or less cylindrical. Cell apex pointed. Cell size: $12\ \mu\text{m} \times 4\ \mu\text{m}$.

It is a rare species. This is the first record in Argentina, in a shallow lake (Corrientes Province, warm waters).

EXCLUDED SPECIES

Kirchneriella sektiiana Gonzalez Guerrero, 1941 cited for Argentina is a doubtful species that Komarek & Fott (1983) synonymised with *Selenoderma sektiiana* (Guerr.) Kom. et Fott.

DISCUSSION

The identification of the different infrageneric taxa of *Kirchneriella* based on morphological features presents no particular difficulties. In general terms, the characters are easily distinguishable and the species clearly defined (Komarek & Fott, 1983).

A high percentage of the species described in the world were also recorded in Argentina. In our samples, the individuals of each species were never found in large numbers. They are commonly associated with other planktonic algae, in particular representatives of the Order Chlorococcales. Despite the lack of any study on the biogeography of the genus *Kirchneriella*, the results of a large number of both taxonomic data and floras suggest that most of the species are distributed worldwide. However, our maps show that some species are irregularly distributed among the different climates of a region, with most of the species and varieties concentrated in warm and temperate areas.

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